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What is Claimed is:

1 ~~sub A'~~ A combination of additives for use in a brightening stage of  
2 pulps containing less than 18% lignin, said combination comprising: an aqueous  
3 sodium silicate solution; an alkali agent added in an amount sufficient to maintain  
4 a pH of said solution at least about 8; and a magnesium compound which  
5 dissociates in said solution to form  $\text{Mg}(\text{OH})^+$  cations, wherein said magnesium  
6 compound is added in an amount to achieve, along with any other dissociated  
7 magnesium, an  $\text{Mg}:\text{SiO}_2$  mass ratio of between about 1:46 to about 1:2.

1 2. A combination of additives in accordance with claim 1,  
2 wherein said  $\text{Mg}:\text{SiO}_2$  mass ratio is between about 1:15 to about 1:3.

1 3. A combination of additives in accordance with claim 1,  
2 wherein said alkali agent is added in an amount sufficient to maintain the pH of  
3 said solution within the range of from about 8 to about 12.

1 4. A combination of additives in accordance with claim 1,  
2 wherein said magnesium compound is magnesium sulfate, added as  $\text{MgSO}_4$  or  
3  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ .

1 5. A combination of additives in accordance with claim 1,  
2 wherein:

3 said aqueous sodium silicate solution is added in an amount to  
4 achieve a concentration of from about 0.14% to about 1.4%  $\text{SiO}_2$  on pulp; and

5 said magnesium compound is added in an amount to achieve a  
6 concentration of from about 0.01% to about 0.2% Mg on pulp.

1 6. A combination of additives in accordance with claim 5,  
2 wherein:

3 said aqueous sodium silicate solution is added in an amount to  
4 achieve a concentration of from about 0.28% to about 1.12%  $\text{SiO}_2$  on pulp; and

5 said magnesium compound is added in an amount to achieve a  
6 concentration of from about 0.02% to about 0.2% Mg on pulp.

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1           7. A combination of additives in accordance with claim 1,  
2 wherein said alkali agent is selected from the group consisting of at least one of  
3 NaOH, Na<sub>2</sub>O, MgO, Mg(OH)<sub>2</sub>, K<sub>2</sub>O, KOH, CaO, and Ca(OH)<sub>2</sub>.

1           8. A combination of additives in accordance with claim 1,  
2 wherein said magnesium compound is selected from the group consisting of at  
3 least one of MgO, MgCl<sub>2</sub>, Mg(OH)<sub>2</sub> and MgNO<sub>3</sub>.

1           ~~sub 2~~ 9. An aqueous composition for use in a brightening stage of  
2 pulps comprising:

3           pulp containing less than 18% lignin;

4           an aqueous sodium silicate solution;

5           an alkali agent added in an amount sufficient to maintain the pH at  
6 least about 8; and

7           a magnesium compound which dissociates in said solution to form  
8 Mg(OH)<sup>+</sup> cations, wherein said magnesium compound is added in an amount to  
9 achieve, along with any other dissociated magnesium, an Mg:SiO<sub>2</sub> mass ratio of  
10 between about 1:46 to about 1:2.

1           10. An aqueous composition in accordance with claim 9, wherein  
2 said Mg:SiO<sub>2</sub> mass ratio is between about 1:15 to about 1:3.

1           11. An aqueous composition in accordance with claim 9, wherein  
2 said alkali agent is added in an amount sufficient to maintain the pH of said  
3 solution within the range of from about 8 to about 12.

1           12. An aqueous composition in accordance with claim 9, wherein  
2 said magnesium compound is magnesium sulfate, added as MgSO<sub>4</sub> or  
3 MgSO<sub>4</sub>·7H<sub>2</sub>O.

1           13. An aqueous composition in accordance with claim 9, wherein:  
2           said aqueous sodium silicate solution is added in an amount to  
3 achieve a concentration of from about 0.14% to about 1.4% SiO<sub>2</sub> on pulp; and  
4           said magnesium compound is added in an amount to achieve a  
5 concentration of from about 0.01% to about 0.2% Mg on pulp.

1           14. An aqueous composition in accordance with claim 13,  
2 wherein:

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3 said aqueous sodium silicate solution is added in an amount to  
4 achieve a concentration of from about 0.28% to about 1.12% SiO<sub>2</sub> on pulp; and

5 said magnesium compound is added in an amount to achieve a  
6 concentration of from about 0.02% to about 0.2% Mg on pulp.

1 15. An aqueous composition in accordance with claim 9, wherein  
2 said alkali agent is selected from the group consisting of at least one of NaOH,  
3 Na<sub>2</sub>O, MgO, Mg(OH)<sub>2</sub>, K<sub>2</sub>O, KOH, CaO and Ca(OH)<sub>2</sub>.

1 16. An aqueous composition in accordance with claim 9, wherein  
2 said magnesium compound is selected from the group consisting of at least one of  
3 MgO, MgCl<sub>2</sub>, Mg(OH)<sub>2</sub> and MgNO<sub>3</sub>.

1 17. An aqueous composition in accordance with claim 9, wherein  
2 said pulp contains less than 5% lignin.

1 18. An aqueous composition in accordance with claim 17,  
2 wherein said pulp contains less than 2% lignin.

1 19. An aqueous composition in accordance with claim 9 further  
2 comprising hydrogen peroxide.

1 ~~20A3~~ 20. A method for brightening pulp comprising the steps of:  
2 mixing pulp containing less than 18% lignin with hydrogen  
3 peroxide, an aqueous sodium silicate solution; an alkali agent added in an amount  
4 sufficient to maintain the pH of said solution at least about 8; and a magnesium  
5 compound which dissociates in said solution to form Mg(OH)<sup>+</sup> cations, wherein  
6 said magnesium compound is added in an amount to achieve, along with any other  
7 dissociated magnesium, an Mg:SiO<sub>2</sub> mass ratio of between about 1:46 to about  
8 1:2, to form a mixture; and

9 heating said mixture to allow said mixture to react to cause a portion  
10 of said lignin to degrade.

1 21. A method in accordance with claim 20 further comprising  
2 pressurizing said mixture with an oxygen-containing gas.

1 ~~22~~ 22. A method for delignifying and brightening pulp comprising  
2 the steps of:

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3 mixing pulp containing less than 18% lignin with an aqueous sodium  
4 silicate solution; an alkali agent added in an amount sufficient to maintain the pH  
5 of said solution at least about 8; and a magnesium compound which dissociates in  
6 said solution to form  $\text{Mg}(\text{OH})^+$  cations, wherein said magnesium compound is  
7 added in an amount to achieve, along with any other dissociated magnesium, an  
8  $\text{Mg}:\text{SiO}_2$  mass ratio of between about 1:46 to about 1:2, to form a mixture;

9 pressurizing said mixture with an oxygen-containing gas; and  
10 heating said mixture to allow said mixture to react to cause a portion  
11 of said lignin to degrade.

1 23. A method in accordance with claim 22 wherein the oxygen  
2 partial pressure is in the range of between about 0.38 to about 1.48 MPa.

1 ~~24.~~ A method for brightening pulp containing transition metals  
2 and less than 18% lignin, said method comprising the steps of:

3 forming a sodium silicate solution having a high percentage of high  
4 molecular weight silicates by mixing sodium silicate and a magnesium compound  
5 which dissociates in said solution to form  $\text{Mg}(\text{OH})^+$  cations; and

6 adding said sodium silicate mixture to said pulp to adsorb at least a  
7 portion of said transition metals.

1 25. A method of claim 24, wherein said sodium silicate mixture  
2 has at least 25% of the silicates with molecular weight of at least 10,000 daltons.

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